Appendix H–Supplemental Documents

List of Supplemental Documents

- Health Consultation – Evaluation of Metals in Bullhead, Bass, and Kokanee from Lake Coeur d'Alene. September 19, 2003.

- Summary Report – Summary Report for the ATSDR Soil-Pica Workshop. June 2000 Atlanta, Georgia. March 20, 2001.

- Health Study – Coeur d'Alene River Basin Environmental Health Assessment. August 2000.

- Health Consultation – Coeur d'Alene River Basin/Common Use Areas (a/k/a Spokane River – Washington State Common Use Area Sediment Characterization). June 23, 2000.

- Health Consultation – Basin-Wide Residential Properties sampled under Field Sampling Plan Addendum 06 (FSPA06). May 16, 2000.

- Health Consultation – Coeur d'Alene River Basin/Common Use Areas (a/k/a Coeur d'Alene River Basin Panhandle Region of Idaho). April 13, 2000.

Health Consultation

COEUR D'ALENE RIVER BASIN
PANHANDLE REGION OF IDAHO
INCLUDING BENEWAH, KOOTENAI &
SHOSHONE COUNTIES

BASIN-WIDE RESIDENTIAL PROPERTIES
SAMPLED UNDER FIELD SAMPLING PLAN ADDENDUM 06 (FSPA06)

MAY 16, 2000

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Agency for Toxic Substances and Disease Registry
Office of Regional Operations
Atlanta, Georgia 30333

Health Consultation: A Note of Explanation

An ATSDR health consultation is a verbal or written response from ATSDR to a specific request for information about health risks related to a specific site, a chemical release, or the presence of hazardous material. In order to prevent or mitigate exposures, a consultation may lead to specific actions, such as restricting use of or replacing water supples; intensifying environmental sampling; restricting site access; or removing the contaminated material.

In addition, consultations may recommend additional public health actions, such as conducting health surveillance activities to evaluate exposure or trends in adverse health outcomes; conducting biological indicators of exposure studies to assess exposure; and providing health education for health care providers and community members. This concludes the health consultation process for this site, unless additional information is obtained by ATSDR which, in the Agency's opinion, indicates a need to revise or append the conclusions previously issued.

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HEALTH CONSULTATION

Coeur d'Alene River Basin
Panhandle Region of Idaho
Including Benewah, Kootenai, &
Shoshone Counties

Basin-Wide Residential Properties
sampled under Field Sampling Plan Addendum 06 (FSPA06)

Prepared by
Office of Regional Operations, Region X
Agency For Toxic Substances & Disease Registry
U.S. Public Health Service
Department of Health and Human Services

Summary

The Agency for Toxic Substances and Disease Registry (ATSDR) was requested by the Environmental Protection Agency (EPA) to review environmental sampling data from 80 residential properties sampled in the Coeur d'Alene River Basin. These homes are outside of the Bunker Hill Superfund Site. Because of prevalent mining and smelting activities, increased levels of lead have been seen throughout the basin. The health threat posed by lead contamination in soil, indoor dust, and water to children was evaluated through 1) calculation of an estimated daily intake (dose) and comparison to an Intake Of Concern for the population (IOC), 2) estimation of expected blood lead levels through use of the EPA's Integrated Exposure Uptake Biokinetic Model for Lead (IEUBK), and 3) estimation of blood lead levels through an ATSDR integrated exposure regression analysis model for use at lead sites. Results of these methods were then compared to blood lead levels associated with adverse health effects.

NOTE: *The methods used in this health consultation are solely for the purpose of screening, and are not meant to predict actual conditions within the Basin. The intent of this screening is to identify those residences which should be considered further, particularly for blood lead screening and possible remedial activities.*

Based on the three methodologies utilized in this health consultation and currently available data, a public heath hazard may exist for children living at more than half of the residences sampled through FSPA06. Of particular concern are residences 12, 13, 15, 32, 39, 40, 43, 44, 46, 50, 51, 58, 62, 64, 67, 74, 76, & 77. Children in approximately 50 homes had estimated lead exposures twice the IOC and/or estimated blood lead levels in excess of the Centers for Disease Control and Prevention (CDC) action level of 10 µg/dl. Results of this evaluation suggest that children one to two years old may be the population of concern for elevated blood lead levels.

Overt health effects from lead exposure may not be apparent in individuals at these blood lead levels, but concern is based upon findings of population based studies. Data suggest that children in some of these residences may be at risk for subtle neurobehavioral and developmental effects. Increased hazard may also be likely if other routes of exposure unaccounted for in these calculations, such as lead based paint, consumption of biota, and recreational activities in the basin, are a significant route of exposure to lead.

Recommendations include intervention strategies that differ based on the level of risk. Medical surveillance strategies such as blood lead monitoring and the current intervention program should be continued or initiated. Blood lead levels for children in these homes should be obtained to identify which children need follow-up and to evaluate the predictive models.

Purpose and Health Issues

The Agency for Toxic Substances and Disease Registry (ATSDR) was requested by the Environmental Protection Agency (EPA) to review environmental data on the Coeur d'Alene River Basin residential properties sampled under field sampling plan addendum 06 (FSPA06) as part of the basin-wide remedial investigation/feasibility study (RI/FS). Residential samples were collected and analyzed for heavy metals. The EPA specifically requested ATSDR to:

1. Evaluate the health threat posed by lead in soil, dust, paint, drinking water, and vegetables to the residents of the Coeur d'Alene River Basin.
2. Determine the need for emergency or time-critical removal of contaminated media.
3. Make recommendations for long-term remediation strategies including how to deal with lead-based paint or lead plumbing.
4. Where should intervention be considered? What should an intervention program include? Which yards should be addressed as part of a clean-up action?

Background

Heavy metals, including lead, arsenic, and cadmium, have been found throughout the Coeur d'Alene River Basin as a result of extensive mining in the Silver Valley for the past century. The Coeur d'Alene River Basin covers approximately 3, 700 square miles with 11, 000 people living in the river basin. The Bunker Hill Superfund Site is a 21 square mile area around the former smelter, inside the river basin. Silver was discovered in the South Fork of the Coeur d'Alene River Basin (Basin) in the late 1880s. Silver, lead, zinc, cadmium, copper, and gold were actively mined. Mining and smelting activities lead to high concentrations of metals in mine waste and tailings, which continue to erode (URS, 1998). Metals may also leach from mine waste and tailings. This health consultation focuses on the review of environmental data from residences in the river basin but outside of the Superfund site.

Soil, indoor dust, and tap water samples were collected from 80 residential properties throughout the river basin. Residences were sampled only if the homeowner requested the sampling and the residence met EPA's criteria of having a child under the age of seven or a pregnant woman living in the household (URS, 1999). Other possible situations such as a family that moves into the area or a pregnant woman that is not aware she is pregnant were not included in the sampling conducted here, but should be evaluated in the future. Samples were analyzed for heavy metals but only results for lead are presented and analyzed in this health consultation. Lead has been the primary driver of health risk, particularly to children, at the Bunker Hill Superfund Site ("Box), and is the primary contaminant of concern for the Basin. However, the other metals need to be evaluated further. All results are quality assured. Specific results for each of the residential properties sampled are seen in Appendix A. Yard surface soil lead levels ranged from 26.9 to

16,000 milligram per kilogram (mg/kg). Additionally, indoor house dust, tap water, and surface soils in play areas and gardens were sampled. Surface soils were a composite mix of four subsamples for each area, from the top 0-1 inches of soil below the ground surface. Indoor dust was sampled from the household's vacuum cleaner bag. Both first-run and flushed water samples were taken from the residences sampled. Both municipal and private water sources were sampled in the study, depending on the residential water source. For the complete field sampling plan, see URS, 1998.

Discussion

Each residence was evaluated for potential health risk to young children approximately 12-24 months of age (with some variation) using three screening methodologies. Results of each method were evaluated using available information concerning lead exposure and associated adverse health effects (CDC, 1997; ATSDR, 1999). These methods were utilized for the purpose of screening environmental concentrations at these residences and were not meant to predict actual blood lead levels or health effects in children living at these residences. Certain variables which impact exposure, such as activity patterns, climate, and geography, are not reflected in these methods. Because these residences were self-selected for sampling, they may not be representative of lead concentrations in the Basin. Details of each method are contained in Appendix B and results are in Appendix C.

1. Method 1 quantifies risk through calculation of an estimated daily intake dose and comparison to an intake of concern for the population (IOC)* for lead developed by the Ontario Ministry of the Environment and Energy (MOEE, 1994; MOEE, 1996). The IOC of 1.85 μg Pb/kg/day is a daily intake which will result in greater than 95% of children exposed having blood lead levels less than 10 μg/dl (MOEE, 1994; MOEE, 1996). In this health consultation, these exposure dose estimates are compared to the toxicological literature to determine what health effects, if any, are possible.

2. Method 2 utilizes the EPA's Integrated Exposure Uptake and Biokinetic Model (IEUBK) for predicting lead exposures in children (EPA, 1994) which provides estimates

* The Minister of Environment and Energy (MOEE) defines the IOC as the average daily intake from all media (food, drinking water, soil, air) which would present a low risk to children's health. MOEE's goal is to reduce children's blood lead levels below 10 μg/dl. 10μg/dl is identified by MOEE as the Lowest Observed Adverse Effect Level (LOAEL) for lead in children. The IOC was developed by estimating what daily intake of lead would result in a blood lead of 10 μg/dl using a bioavailability factor of 0.21. This value of 3.7 μg Pb/kg/day was divided by an uncertainty factor of 2 (rational for this factor not provided) to obtain the IOC of 1.85 μg Pb/kg/day. MOEE believes this IOC will result in greater than 95% of children with blood lead levels lower than 10 μg/dl.

(geometric mean) of lead in blood. Surface soil and indoor dust samples were used as input values for the model in order to calculate expected children's blood lead levels. The default age range evaluated in the model is 0-84 months.

3. Method 3 estimates blood lead levels using ATSDR's integrated exposure regression analysis model (Appendix D in ATSDR 1999). This approach utilizes slope values from selected studies which correlate environmental lead levels with blood lead levels, to integrate all exposures from various pathways, thus providing a cumulative exposure estimate expressed as total blood lead.

NOTE: *The methods used in this health consultation are solely for the purpose of screening, and are not meant to predict actual conditions within the Basin. The intent of this screening is to identify those residences which should be considered further, particularly for blood lead screening and possible remedial activities.*

Method 1 Summary Results:
External doses calculated from each route were summed to calculate total dose. This total estimated dose for each residence, in mg/kg/day, was then compared to the IOC by dividing the estimated dose by the IOC to determine how many times the estimated dose was greater than the IOC. The following were the results of this calculation:

Table 1. Number of times the IOC was exceeded by estimated dose (dose/IOC).

Number of times dose exceeds IOC	n	Location ID
less than IOC	3	47, 72, 73
from = to IOC to less than (<)2 times the IOC	14	3, 4, 6, 8, 10, 17, 25,33, 35, 48, 49, 60, 75, 79
from 2 < 3	14	1, 20, 27, 29, 41, 42, 53, 54, 55, 56, 61, 63, 68, 71
3 < 4	13	2, 7, 9, 11, 18, 19, 24, 26, 31, 36, 37, 45, 80
4 < 5	9	14, 23, 38, 40, 52, 57, 66, 69, 78
5 < 6	7	5, 16, 28, 34, 59, 65, 70
6 < 7	4	21, 22, 30, 46
7 < 8	0	
8 < 9	1	77

Number of times dose exceeds IOC	n	Location ID
9 < 10	2	58, 67
10 < 15	10	12, 15, 32, 43, 44, 51, 62, 64, 74, 76
15 < 20	0	
greater than 20	3	13, 39, 50

n = number of residences

Children living at these residences would have an estimated external dose an average of 5.8 times greater than the IOC, with a median value of 3.6, and a minimum and maximum of 0.3 and 60, respectively. Estimated doses range as high as 0.1114 mg/kg/day, with 21 dose estimates exceeding 0.01 mg/kg/day. Appendix D contains a table listing the studies in humans and animals which have shown effects at doses ranging from 0.01 mg/kg/day to 0.3 mg/kg/day.

Method 2 Summary Results:
Based upon inputs to the IEUBK model, residential locations had the following expected blood levels:

Table 2. Average estimated blood lead levels for each residence

Average BPb level in µg/dl	n	Locations
Less than 10	48	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 14, 17, 18, 19, 20, 23, 24, 25, 26, 27, 29, 31, 33, 35, 36, 37, 41, 42, 45, 47, 48, 49, 53, 54, 55, 56, 57, 60, 61, 63, 68, 69, 71, 72, 73, 75, 79, 80
10-14	16	5, 16, 21, 22, 28, 30, 34, 38, 40, 46, 52, 59, 65, 66, 70, 78
15-19	8	12, 44, 51, 58, 62, 64, 67, 77
20-44	7	13, 15, 32, 43, 50, 74, 76
45-69	1	39

n = number of residences

Estimated blood lead levels for these residences appear to be higher than the blood lead levels of children actually measured in the State of Idaho's Basin Exposure Assessment (see below; IDHW, 1999). One reason may be that the number of children tested in the Exposure Assessment was small (98) and thus may not be representative. Another reason may be due to high uncertainty regarding children's lead absorption and bioavailability in the IEUBK model (Mahaffey, 1998). This health consultation also made some assumptions about intake and bioavailability to determine which media may pose a risk for young children at these specific residences, and is not attempting to predict blood lead levels in these children nor for residents basin-wide. The State of Idaho is developing site specific bioavailability factors and intake rates for use in the IEUBK model as part of their Human Health Risk Assessment (HHRA) (Terragraphics, April 12, 2000).

The IEUBK model does not take into account activities such as education and other intervention activities which have been occurring in the Basin. If these activities are successful, observed blood lead levels should be less than levels which are predicted based upon environmental concentrations alone. All of the methods used in this health consultation are tools for predicting blood lead levels in "typical children" based upon hypothetical exposure scenarios, and would not be expected to predict current blood lead levels in individual children. Exposures and behaviors not accounted for in these methods may explain some of the differences between predicted and observed results.

Another reason for the apparent discrepancy between these modeled blood lead levels and what has been seen in the State of Idaho's Basin Exposure Assessment (IDHW, 1999) and in the annual blood lead screening in the Basin (Terragraphics, April 14, 2000), is the attempt in this health consultation to focus on one to two year old children. Young children of this age are likely to receive greater exposures in a residential setting because 1) they are more mobile than infants, 2) they have a greater likelihood of exhibiting hand to mouth behavior, and 3) they are likely to spend more time in the house and yard than older children (particularly 6 years and up). One and two year old children are also the most sensitive to the affects of lead exposure because of their developing nervous system. In the State of Idaho's Basin Exposure Assessment, as well as in the annual blood lead screening in the Basin, children from 9 months to 9 years of age were tested.

Nationwide, the CDC (1997) has found that one to two year old children are more likely to have elevated blood lead levels from exposure to lead based paint in the home than children of other ages. This may not be truly reflective of the Basin as contamination is primarily from sources other than lead paint, and older children are at risk from activities outside the house. However, it would be expected that the percentage of child with blood lead levels greater than 10 μg/dl in a sample of children from 9 months to 9 years old would be lower than the percentage in a sample of children age 1 to 2 years. Data from inside the "Box" reflect the CDC finding, showing that the percentage of 1 to 2 year old children greater than or equal to 10 μg/dl (approximately 20% in 1998 and approximately 15% in 1999) has been at least twice as great as the percentage in children ages 3 to 9 (Terragraphics, April, 14,2000). The 1999 blood lead survey results for the Basin showed that 16% of children age 1 - 6 exceeded 10 μg/dl (Terragraphics, April 12, 2000).